

WHAT IS CLAIMED IS:

1 1. A method for manufacturing a trench-type MOSFET, the method
2 comprising:
3 providing a semiconductor substrate and forming a trench on the
4 semiconductor substrate;
5 forming a first oxide layer on a bottom and sidewalls of the trench and on
6 the semiconductor substrate;
7 forming a bottom anti-reflective coating (BARC) layer in the trench to
8 cover the first oxide layer;
9 forming a photoresist layer on the bottom anti-reflective coating layer;
10 removing the photoresist layer;
11 removing the bottom anti-reflective coating layer; and
12 removing the first oxide layer on the sidewalls of the trench to form a
13 bottom oxide layer on the bottom of the trench.

1 2. The method of claim 1 wherein providing the semiconductor
2 substrate and forming the trench comprises:
3 forming a pad oxide layer, a silicon nitride layer, and a mask oxide layer
4 sequentially on the semiconductor substrate; and
5 removing portions of the pad oxide layer, the silicon nitride layer, the mask
6 oxide layer, and the semiconductor substrate to form the trench.

1 3. The method of claim 2 wherein removing the portions is performed
2 by a photolithography process and an etching process.

1 4. The method of claim 2 further comprising after removing the
2 portions:
3 forming a sacrificial oxide layer on the sidewalls of the trench; and
4 removing the sacrificial oxide layer.

1 5. The method of claim 4 wherein the sacrificial layer is formed by
2 thermal oxidation.

1 6. The method of claim 4 wherein the sacrificial oxide layer is
2 removed by etching.

1 7. The method of claim 1 wherein the first oxide layer is formed by
2 chemical vapor deposition (CVD).

1 8. The method of claim 1 wherein the bottom anti-reflective layer is
2 formed by deposition.

1 9. The method of claim 1 wherein the bottom anti-reflective layer is
2 removed by etching.

1 10. The method of claim 9 wherein the bottom anti-reflective layer is
2 removed by etching using a chemical compound which contains sulfuric acid.

1 11. The method of claim 1 wherein the first oxide layer is removed by
2 etching.

1 12. The method of claim 11 wherein the first oxide layer is removed by
2 etching using a chemical compound which contains hydrofluoric acid.

1 13. The method of claim 1 further comprising depositing a polysilicon
2 layer in the trench after removing the first oxide layer on the sidewalls of the trench.

1 14. A method for manufacturing semiconductor devices, the method
2 comprising:

3 providing a semiconductor substrate having a trench on the semiconductor
4 substrate;

5 forming a first oxide layer on a bottom and sidewalls of the trench and on
6 the semiconductor substrate;

7 forming a bottom anti-reflective coating (BARC) layer in the trench to
8 cover the first oxide layer;

9 forming a photoresist layer on the bottom anti-reflective coating layer; and

10 removing the photoresist layer, the bottom anti-reflective coating layer, and
11 the first oxide layer on the sidewalls of the trench to form a bottom oxide layer on the
12 bottom of the trench.

1 15. The method of claim 14 wherein providing the semiconductor
2 substrate having the trench comprises:

3 forming a pad oxide layer, a silicon nitride layer, and a mask oxide layer
4 sequentially on the semiconductor substrate; and
5 removing portions of the pad oxide layer, the silicon nitride layer, the mask
6 oxide layer, and the semiconductor substrate to form the trench.

1 16. The method of claim 15 further comprising after removing the
2 portions:

3 forming a sacrificial oxide layer on the sidewalls of the trench; and
4 removing the sacrificial oxide layer.

1 17. The method of claim 15 further comprising depositing a polysilicon
2 layer in the trench after removing the first oxide layer on the sidewalls of the trench.

1 18. A method for manufacturing semiconductor devices, the method
2 comprising:

3 providing a semiconductor substrate having a trench on the semiconductor
4 substrate;

5 forming a first oxide layer on a bottom and sidewalls of the trench and on
6 the semiconductor substrate;

7 forming a bottom anti-reflective coating (BARC) layer over the first oxide
8 layer, the bottom anti-reflective coating layer filling the trench;

9 forming a photoresist layer on the bottom anti-reflective coating layer; and

10 removing the photoresist layer, the bottom anti-reflective coating layer, and
11 the first oxide layer on the sidewalls of the trench to form a bottom oxide layer on the
12 bottom of the trench.

1 19. The method of claim 18 wherein providing the semiconductor
2 substrate having the trench comprises:

3 forming a pad oxide layer, a silicon nitride layer, and a mask oxide layer
4 sequentially on the semiconductor substrate;

5 removing portions of the pad oxide layer, the silicon nitride layer, the mask
6 oxide layer, and the semiconductor substrate to form the trench;

7 forming a sacrificial oxide layer on the sidewalls of the trench; and
8 removing the sacrificial oxide layer.

1 20. The method of claim 18 further comprising depositing a polysilicon
2 layer in the trench after removing the first oxide layer on the sidewalls of the trench.